

1 --16.(as amended) A hand held pointing device for a computer system, the pointing device comprising:  
2       a housing having a bottom surface that moves against a desktop surface;  
3       the housing also having a top surface shaped to receive the human hand;  
4       the housing also having a skirt connecting a perimeter of the bottom surface with the  
5       top surface;  
6               the housing also having a first axis extending generally in the direction from where the  
7       heel of the hand rests on the top surface to where the middle finger rests on the top surface, and  
8       a second axis perpendicular to the first, both axes parallel to the bottom surface;  
9               an aperture in the bottom surface;  
10          a source of non-coherent illumination mounted within the interior of the housing,  
11       proximate the aperture, that illuminates, from a single location and with an angle of incidence in  
12       the range of about five to twenty degrees, a portion of the desktop surface opposite the aperture  
13       and having surface height irregularities forming a micro texture with feature sizes in the range of  
14       about five to five hundred microns, the illumination producing highlights upon surface height  
15       irregularities that extend out of the desktop surface and that intercept the illumination and shadows  
16       upon surface height irregularities that extend into the desktop surface and whose illumination is  
17       blocked by adjacent surface height irregularities that are illuminated, the highlights and shadows  
18       forming a pattern that varies as a function of rotations and translations of the aperture relative to  
19       the desktop;  
20               an optical motion detection circuit mounted within the interior of the housing and  
21       optically coupled to the highlights and shadows from the surface height irregularities of the  
22       illuminated portion of the desktop surface, the optical motion detection circuit producing motion  
23       signals indicative of motion in the directions along the first and second axes and relative to the  
24       surface height irregularities of the illuminated portion of the desktop surface; and  
25               wherein the optical motion detection circuit comprises [a plurality]an array of photo  
26       detectors each having an output, a memory containing a reference frame of digitized photo  
27       detector output values that is stored in a reference array of memory locations corresponding to  
28       the array of photo detectors and a sample frame of digitized photo detector output values obtained  
29       subsequent to the reference frame and that is stored in a sample array of memory locations  
     corresponding to the array of photo detectors, and further wherein a plurality of comparison

31           frames, each being a shifted version of one of the reference frame or the sample frame, is  
32           correlated with the other of the reference frame or the sample frame to ascertain motion in the  
33           directions along the first and second axes, the correlation being upon the values in all memory  
34           array locations that correspond to overlap between the comparison frame and the other of the  
35           reference frame or the sample frame.--;

1   --21.(as amended) A hand held pointing device for a computer system, the pointing device comprising:  
3           a housing having a bottom surface that moves against a work surface;  
5           the housing also having a top surface shaped to receive the human hand;  
7           the housing also having a skirt connecting a perimeter of the bottom surface with the  
9           top surface;

11           the housing also having a first axis extending generally in the direction from where the  
13           heel of the hand rests on the top surface to where the middle finger rests on the top surface, and  
15           a second axis perpendicular to the first, both axes parallel to the bottom surface;

17           an aperture in the bottom surface;

19           a source of illumination mounted within the interior of the housing, proximate the  
21           aperture, that illuminates a portion of the work surface opposite the aperture and having surface  
23           height irregularities forming a micro texture with feature sizes in the range of about five to five  
25           hundred microns, the illumination producing a pattern of highlights upon surface height  
27           irregularities that extend out of the desktop surface and that intercept the illumination and of  
29           shadows upon surface height irregularities that extend into the desktop surface and whose  
31           illumination is blocked by adjacent surface height irregularities that are illuminated;

33           an optical motion detection circuit mounted within the interior of the housing and  
35           optically coupled to the pattern of highlights and shadows from the surface height irregularities  
37           of the illuminated portion of the work surface, the optical motion detection circuit producing  
39           motion signals indicative of motion in the directions along the first and second axes and relative  
41           to the surface height irregularities of the illuminated portion of the work surface;

43           wherein the optical motion detection circuit comprises [a plurality] an array of photo  
45           detectors each having an output, a memory containing a reference frame of digitized photo  
47           detector output values that is stored in a reference array of memory locations corresponding to

25       the array of photo detectors and a sample frame of digitized photo detector output values obtained  
26        subsequent to the reference frame and that is stored in a sample array of memory locations  
27        corresponding to the array of photo detectors, and further wherein a plurality of comparison  
28        frames, each being a shifted version of one of the reference frame or the sample frame, is  
29        correlated with the other of the reference frame or the sample frame to ascertain motion in the  
30        directions along the first and second axes, the correlation being upon the values in all memory  
31        array locations that correspond to overlap between the comparison frame and the other of the  
32        reference frame or the sample frame; and

33            a switch disposed on the skirt in a location underneath the right thumb or the left ring  
34        finger of a hand grasping the pointing device, that is coupled to the optical motion detection circuit  
35        and that inhibits the output of the motion signals to the computer system when the hand activates  
36        the switch by squeezing against the skirt in a plane parallel to the bottom surface in order to lift  
37        the pointing device away from the desktop surface.--; and

1   --22.(as amended) A hand held pointing device for a computer system, the pointing device comprising:  
2        a housing having a bottom surface that moves against a work surface;  
3        the housing also having a top surface shaped to receive the human hand;  
4        the housing also having a skirt connecting a perimeter of the bottom surface with the  
5        top surface;

6            the housing also having a first axis extending generally in the direction from where the  
7        heel of the hand rests on the top surface to where the middle finger rests on the top surface, and  
8        a second axis perpendicular to the first, both axes parallel to the bottom surface;

9            an aperture in the bottom surface;

10          a source of illumination mounted within the interior of the housing, proximate the  
11        aperture, that illuminates a portion of the work surface opposite the aperture and having surface  
12        height irregularities forming a micro texture with feature sizes in the range of about five to five  
13        hundred microns, the illumination producing a pattern of highlights upon surface height  
14        irregularities that extend out of the desktop surface and that intercept the illumination and of  
15        shadows upon surface height irregularities that extend into the desktop surface and whose  
16        illumination is blocked by adjacent surface height irregularities that are illuminated;

17               an optical motion detection circuit mounted within the interior of the housing and  
18               optically coupled to the pattern of highlights and shadows from the surface height irregularities  
19               of the illuminated portion of the work surface, the optical motion detection circuit producing  
20               motion signals indicative of motion in the directions along the first and second axes and relative  
21               to the surface height irregularities of the illuminated portion of the work surface;

22               wherein the optical motion detection circuit comprises [a plurality]an array of photo  
23               detectors each having an output, a memory containing a reference frame of digitized photo  
24               detector output values that is stored in a reference array of memory locations corresponding to  
25               the array of photo detectors and a sample frame of digitized photo detector output values obtained  
26               subsequent to the reference frame and that is stored in a sample array of memory locations  
27               corresponding to the array of photo detectors, and further wherein a plurality of comparison  
28               frames, each being a shifted version of one of the reference frame or the sample frame, is  
29               correlated with the other of the reference frame or the sample frame to ascertain motion in the  
30               directions along the first and second axes, the correlation being upon the values in all memory  
31               array locations that correspond to overlap between the comparison frame and the other of the  
32               reference frame or the sample frame; and

33               a switch disposed on the skirt in a location underneath the left thumb or the right ring  
34               finger of a hand grasping the pointing device, that is coupled to the optical motion detection circuit  
35               and that inhibits the output of the motion signals to the computer system when the hand activates  
36               the switch by squeezing against the skirt in a plane parallel to the bottom surface in order to lift  
37               the pointing device away from the desktop surface.--.

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